Quantum

User's Guide

Quantum LTFS

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Preface

This manual introduces Quantum Linear Tape File System (LTFS) software and discusses its configuration and operation.

Audience

This manual is written for Quantum LTFS operators and administrators.

Document Organization

Following is a brief description of chapter contents.

- Chapter 1, Quantum LTFS Overview provides an overview of the features, benefits intended usage, architecture and supported configuration.
- Chapter 2, Installation and Configuration provides information about access, installation and configuration.
- Chapter 3, Using Quantum LTFS provides information about using LTFS for Linux and Mac OS X.
- Chapter 4, Troubleshooting provides information about troubleshooting problems.
- Appendix A, Frequently Asked Questions provides answers to frequently asked questions.

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The Service and Support Website contains a collection of information, including answers to frequently asked questions (FAQs).

For further assistance, or if training is desired, contact Quantum:

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Chapter 1

Quantum LTFS Overview

This chapter provides and overview of Quantum LTFS.

- Introduction
- Features
- Benefits
- Intended Usage
- Architecture
- Supported configurations

Introduction

This guide provides information about Quantum Linear Tape File System (LTFS) Software. Quantum LTFS makes tape self-describing, file-based, and easy-to-use, and provides users with the ability to use standard file operations on tape media for accessing, managing and sharing files with an interface that behaves like a hard disk. In addition, Quantum LTFS provides the ability to share data across platforms, as you would with a USB drive or memory stick.

Note: A firmware update may be required for LTO-5 or LTO-6 drives. Quantum LTFS will check and tell you if your tape drive needs updating. Firmware revision V3082 or greater is required.

Features

Quantum LTFS includes the following features:

- Provides all you need to use LTO-5 or later media as a disk
- Based on open source software, subject to EULA terms and LGPL 2.1 requirements
- Precompiled application versions provided for supported platforms
- Full source code available
- Supported on Linux® and MAC OS® X

Benefits

In addition to the wide range of benefits that Quantum LTO-5 or later tape drives have to offer, these drives with Linear Tape File System (LTFS) functionality also deliver:

- Faster access to data: When a tape is mounted, the files and directories stored on it appear on the desktop in the same way as a disk directory listing.
- Simple drag and drop: Quantum LTFS increases ease of use, simply drag and drop files to and from the tape.
- Compatibility across your environment: Tape media written using Quantum LTFS is self-describing so that data retrieval from tape is independent of any hardware or software platforms.
- Increased data mobility: Easily share content to increase data mobility; tapes written with Quantum LTFS application can be exchanged more easily between users working on different operating systems, using different software and in different locations.
- A single storage media standard: Unify organization-wide file sharing with Quantum LTO-5 or later tape drives. Tapes can move across libraries and vendors with the ease of video cassettes, while files on tape can be accessed using straightforward drag-and-drop.

Intended Usage

Quantum LTFS application presents the contents of the tape like a disk volume. However it is important to bear in mind that it is not a true disk, therefore there are some best practices to follow to ensure satisfactory performance and a good user experience.

- Quantum LTFS is designed to work best in a single-user environment, where just one user is copying files to or from the tape. Multiple users or processes trying to write and/or read at the same time will result in poor performance due to the sequential access nature of tape.
- For the same reasons, the tape drive should not be shared between different systems. A single tape drive should be connected to a single host bus adaptor (HBA).
- The expected usage model is to transfer large files between systems, by mounting the tape on one system, writing the files, un-mounting, mounting on the second system, and reading the files. Treating the tape volume as a true random access device (for example frequently reading and updating individual files) will not perform as well as streamlining large files to/from tape.
- The Quantum LTFS application will work in conjunction with graphical file explorer programs such as Nautilus (on Linux) or Finder (on Mac OS X). However because these types of applications tend to try to pre-read files in the directory, using the graphical explorer window may lead to poor performance. Optimum performance will be enjoyed by using a terminal window and issuing shell commands to copy data, view directory contents, etc.
- The Quantum LTFS application utilizes a block size of 512 KB. Older Host Bus Adapters may not support that block size, which would prevent being able to create or mount an LTFS volume.
- Tape activity may continue for several minutes after un-mounting an LTFS volume. Do not attempt to remove the tape cartridge, power down the system or tape drive, or delete the folder where the LTFS volume is mounted, until all tape activity has finished. Check the front panel LEDs and wait for them to stop flashing. Attempting these actions before tape activity has finished may cause corruption of the tape format.
- Quantum LTO-5 or later tape drives are optimized for high speed data transfer. For best results, when copying data to or from an LTFS volume, utilize a device which can sustain a transfer rate of at least 50 MB/s.

Architecture

Quantum LTFS is a user space application, making use of the FUSE kernal mode subsystem included in Linux systems. On the Apple Mac OS platform, it uses either the MacFUSE module (in 32-bit kernel mode only) or FUSE for OS X (in either 32-bit or 64-bit kernel mode).

Supported configurations

Quantum LTFS supports:

- LTO-5 or later Tape Drives with SAS interfaces
- Red Hat EL 5 Update 4 x86 or later
- Red Hat EL 5 Update 4 x64 or later
- SSE Linux Server 11 SP1 x86 or later
- SUSE Linux Enterprise Server 11 SP1 x64 or later
- Mac OS X 10.6 (Snow Leopard) or later 32-bit or 64-bit kernel mode

Note: See the Compatibility Matrix on www.quantum.com/LTFS for the latest details on supported operating system and hardware configurations.

Chapter 2

Installation and Configuration

This chapter helps you to install and configure Quantum LTFS and contains the following sections:

- Linux Installation and Configuration
- Mac OS X: Installation and Configuration

Linux Installation and Configuration

When using Quantum LTFS with Quantum LTO-5 or later tape drives, the following components are required:

- A drive firmware revision that supports dual partitioning. Quantum LTFS will check and tell you if your tape drive firmware needs updating
- The software package that contains the "run-time" executable, this can be found at http://www.quantum.com/LTFS.
- The FUSE kernel module and shared libraries

Note: xTalk version 6.4.1.1 or later provides a new LTFS check test that determines whether or not dual partitioning and LTFS are supported. xTalk is not supported under Mac OS.

Downloading and installing Quantum LTFS

To download and install Quantum LTFS:

1. Before starting to install and use Quantum LTFS, you must ensure that the FUSE kernel module is present and loaded. To check whether FUSE is installed, the following commands may be used:

   For RHEL:

   ```
   $ rpm -qi fuse
   ```

   ```
   $ rpm -qi fuse-libs
   ```

   For SLES:

   ```
   $ rpm -qi fuse
   ```

   ```
   $ rpm -qi libfuse2
   ```

   * If the module is not present on your system, you must first obtain and then install it.

   For RHEL 5 Update 4 or later:

   The required FUSE packages are fuse and fuse-libs, version 2.7 or later.

   * If FUSE cannot be installed via an RPM package, the source code may be downloaded from the following location: http://fuse.sourceforge.net

   * After FUSE has been installed, the following command may be used to check whether the module is loaded:

     ```
     $ lsmod | grep fuse
     ```

   - If the module is not listed as currently loaded, you must load it before proceeding:

     ```
     $ modprobe fuse
     ```

2. Determine whether you want to use precompiled utilities or build your own version of the Quantum LTFS application.

   Note: Currently, Quantum only supports installations using the precompiled binaries.

3. To build from the source code, download and unpack the Quantum LTFS source archive:

   qtmltfs-x.x.x.tar.gz

Then, follow the instructions in./qtmltfs-.x.x.x/doc/BUILDING.linux or qtmltfs-.x.x.x/doc/BUILDING.linux.

4 To use precompiled utilities, download the appropriate package for your operating system platform:

For RHEL:

rhelx-qtmltfs-x.x.x-x.i386.rpm (32-bit), or

rhelx-qtmltfs-x.x.x-x.x86_64.rpm (64-bit)

For SLES:

slesxxspx-qtmltfs-x.x.x-x.i586.rpm (32-bit), or

slesxxspx-qtmltfs-x.x.x-x.x86_64.rpm (64-bit)

Download the Quantum LTFS GPG key from the Quantum LTFS download page and import it with the following command:

```
$ rpm --import qtmltfs-public-GPG-key.asc
```

Install the Quantum LTFS package with the following command:

```
$ rpm -ivh package_name
```

For example: `$ rpm -ivh qtmltfs-1.2.0-1.x86_64.rpm`

Note: The binary RPM checks for dependencies in the RPM database. If FUSE was installed by building from the source, the RPM database may not properly reflect that the dependencies have been installed, which will prevent LTFS from being installed. It is possible to work around this by utilizing the --nodeps option to disable dependency checking, when installing the RPM package.

Note: The SLES 11 version of chkconfig command is a little different from standard linux in that, after invoked with either add or delete service option it executes the list mode option of chkconfig to display the new runlevels 0 to 6 to the terminal.

The binary RPM will place links to executables in /usr/local/bin/

(ltfs, mkltfs, ltfsck)

and a number links to dynamic libraries in /usr/local/lib/ (or /usr/local/lib64) and also in a new subdirectory /usr/local/lib/ltfs/ (or /usr/local/lib64/ltfs/).

5 Quantum LTFS is now installed. See Using Quantum LTFS for the next steps.

To uninstall LTFS

If at a later date you want to uninstall LTFS from your system, use the following command:

```
$ rpm -e qtmltfs
```

Mac OS X: Installation and Configuration

When using Quantum LTFS with Quantum LTO-5 or later tape drives, the following components are required:

- A drive firmware revision that supports dual partitioning
- The software package that contains the "run-time" executable
- Either the MacFUSE (32-bit kernel mode only) or FUSE for OS X kernel module (32-bit or 64-bit kernel mode)
- The ICU package (provided)

Note: Quantum LTFS will check and tell you if your tape drive firmware needs updating.

Downloading and installing Quantum LTFS

To download and install Quantum LTFS with precompiled binaries:

1 Before starting to install and use LTFS, you must ensure that the either the MacFUSE module version 2.0.3,2 or FUSE for OS X module version 2.5.1, 2.5.4 or later with MacFUSE Compatibility Layer is present and loaded.

If the module is not present on your system, you must first obtain and install it. MacFUSE or OsxFUSE may be downloaded from the following location:

http://code.google.com/p/macfuse/

Note: MacFUSE has been discontinued so use OsxFUSE for recent releases of OSX.

FUSE for OS X may be downloaded from the following location:

http://osxfuse.github.com

Mount and open the Apple disk image (.dmg) files. Double-click the enclosed package (.pkg) files to install the module.

Note: Currently, Quantum only supports installations using the precompiled binaries.

2 To use precompiled utilities, download the file:

qtmltfs-x.x.x.dmg

3 Open the binary disk image by double clicking on it in a Finder window. The disk image contains the Snow Leopard (Mac OS 10.6) installation package, **LinearTapeFileSystem.pkg** as well as the following support file:

ICUFramework-x.x.x.x.pkg

4 Install the ICU package first by double-clicking on the file **ICUFramework-x.x.x.x.pkg** and following the instructions.

Now install the LTFS package by double-clicking on the file **LinearTapeFileSystem.pkg** and following the instructions.

Note: Packages will not install if all applicable licenses are not accepted.

5 Quantum LTFS is now installed. See Using Quantum LTFS for the next steps.

6 GUI Updates:

- **a** LTFS_Manager.tar.gz is part of the qtmltfs-2.0.0-8 file. Double-click and it extracts LTFS Manager.app
- **b** Move LTFS Manager.app to your desktop or applications folder

c Double-click LTFS Manager.app to begin.

To uninstall LTFS

If at a later date you want to uninstall LTFS from your system, delete **/usr/local/bin/*ltfs*** and then delete the tree under **/Library/Frameworks/LTFS.framework**.

To also delete the ICU package, delete the tree under **/Library/Frameworks/ICU.framework**.

Chapter 3
Using Quantum LTFS

This chapter describes how to work with Quantum LTFS and contains the following sections:

- How to use LTFS - Linux
- How to Use LTFS - Mac GUI
- How to Use LTFS - Mac Terminal Commands
- Usage details

How to use LTFS - Linux

To use Quantum LTFS:

1. Ensure that /usr/local/bin/ is in your command search path. For example:

   ```
   $ export PATH="$PATH:/usr/local/bin"
   ```

2. Load a tape cartridge into the drive, and then format it in LTFS format:

   e.g., for Linux:

   ```
   $ mkltfs -d /dev/st0
   ```

   Note: If the cartridge already has been formatted for LTFS, you need to use the force reformat option (-f) in some cases. Linux example - `$ mkltfs -d /dev/st0 -f`

mkltfs Options

`-d<name> OR --device=<name>`	Tape device (required). For Linux use the device name such as /dev/st0.
`-s<id> OR --tape-serial=<id>`	Tape serial number (6 alphanumeric ASCII characters)
`-n OR --volume-name=<name>`	Tape volume name (empty by default)

-r<rule[/rule]> OR --rules=<rule[,rule]>	Rules for choosing files to write to the index partition. The syntax of the rule argument is: size=1M size=1M/name=pattern size=1M/name=pattern1:pattern2:pattern3 A file is written to the index partition if it is no larger than the given size AND matches at least one of the name patterns (if specified). The size argument accepts K, M and G suffixes. Name patterns may contain the special characters '?' (match any single character) and '*' (match zero or more characters).
-o OR --no-override	Disallow mount-time data placement policy changes
-f OR --force	Force reformat of existing LTFS volume (normally prevented)
-q OR --quiet	Suppress progress information and general messages
-t OR --trace	Enable function call tracing (only useful for debugging)
-h OR --help	This help.
-p OR --advanced help, or --advanced-help	Full help including advanced options.

3 Mount the formatted tape cartridge

```
$ mkdir /mnt/ltfs
$ ltfs /mnt/ltfs
```

Note: Some operating systems require creating each folder or subfolder in separate commands. For example:

```
$ mkdir /mnt
$ cd /mnt
$ mkdir ltfs
$ cd ltfs
```

ltfs Options:

`-o devname=<dev>`	Tape device (required if not using the default device: /dev/ st0 for Linux)
`-o work_directory=<dir>`	LTFS work directory (default: /tmp/ltfs/)
`-o trace`	Enable function call tracing (only useful for debugging)
`-o eject`	Ejects the cartridge after an unmount command.
`-o sync_type=<type>`	Specify sync type (default: time@5) <type> should be specified as follows time@min: LTFS attempts to write an index each min minutes. Min should be the decimal number from 1 to 15372286728912 (default: min=5). Specifying an integer greater than 35791394 on 32-bit Linux systems will result in an error message and the value will not be accepted. Therefore, on 32-bit Linux systems the maximum value displayed for sync_type field is the maximum allowed integer, 35791394. close: LTFS attempts to write an index when a file is closed. unmount: LTFS attempts to write an index when the medium is ummounted.
`-o force_mount_no_eod`	Skips eod existence check when mounting (read only mount). Only use for a CM corrupted medium.

-a	Advanced help, including standard FUSE options
-V or --version	Output version information and exit
-h OR --help	Display this help and exit
-o umask=M	Set file permissions (octal)
-o uid=N	Set file owner
-o gid=N	Set file group

4 Write files to the LTFS volume. For example:

```
$ cp -r /root /mnt/ltfs/
```

5 Unmount the tape cartridge. This flushes the data buffer of the file system to the tape cartridge, and prepare for eject.

```
$ umount /mnt/ltfs
```

or

```
$ fusermount -u /mnt/ltfs
```

Note: The umount (or fusermount) command will return immediately, but the drive may still be busy writing cached data to tape. Do not attempt to remove the tape cartridge, power down the system or tape drive, or delete the folder where the LTFS volume is mounted, until all tape activity has finished. Check the front panel LEDs and wait for them to stop flashing. Attempting these actions before tape activity has finished may cause corruption of the tape format.

If at some time in the future you wish to remove the LTFS format from a cartridge so that it can be reused for a different purpose, use the unltfs command. Note that the unltfs command will **DESTROY** all data on the cartridge. Thus use the unltfs command only when you are sure that you want to erase the LTFS volume.

unltfs Options:

-d devname=<dev>	Tape device (required if not using the default device: /dev/ st0

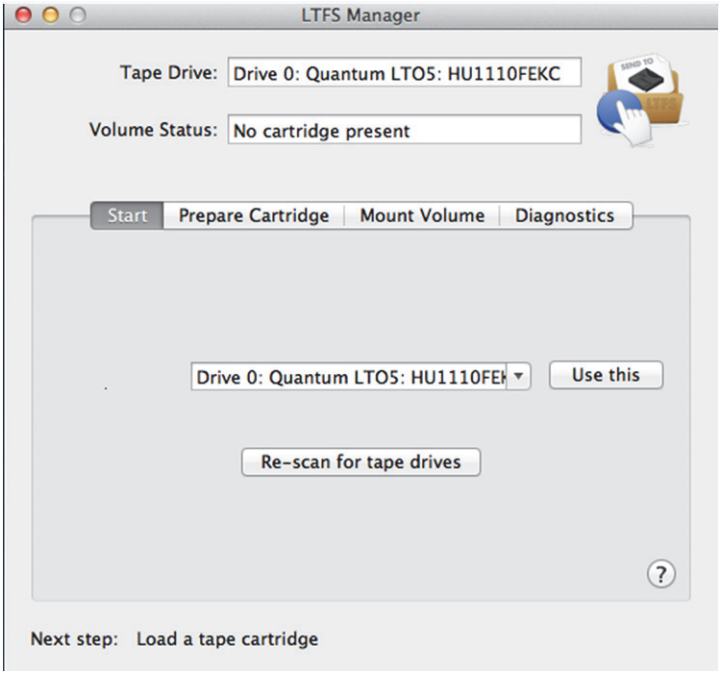
`-y OR --justdoit`	This option omits the normal verification steps and reformats without further prompting
`-t OR --trace`	Enable function call tracing (only useful for debugging)
`-e OR --eject`	Ejects the cartridge after an unmount command
`-q OR --quiet`	Suppresses all progress outputs
`-h OR --help`	Display this help and exit
`-i OR --config=<file>`	Overrides the default configuration file
`-b OR --backend`	Specifies a different tape backend system
`-x OR --fulltrace`	Displays debug information (verbose)

How to Use LTFS - Mac GUI

To access the LTFS GUI on Mac OS:

1 Click **LTFS Manager** from the **Applications** folder or your desktop. The **Start Screen** displays.

Figure 1 Start Screen

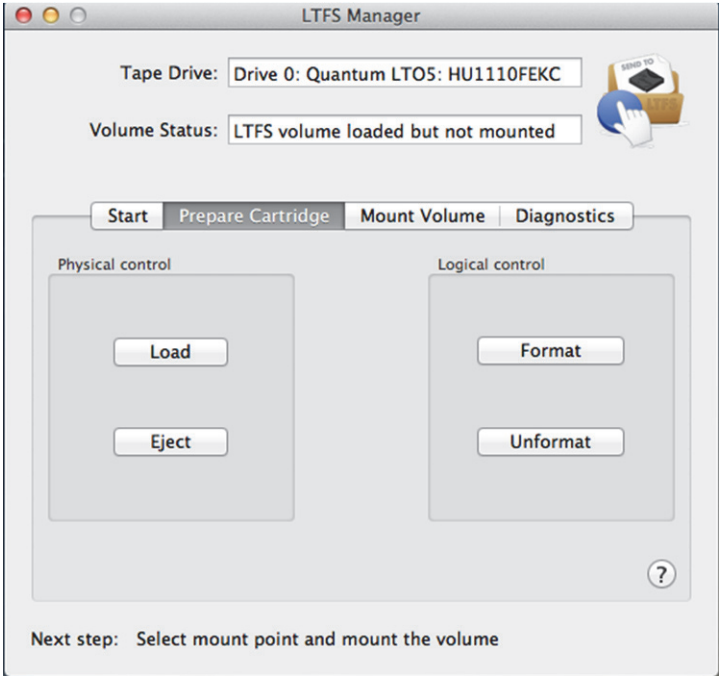


The Start Screen should display the available Quantum tape drive. If there is no drive listed in the drop-down menu, click the **Re-scan for tape drives** button.

Note: If a tape drive still does not display after clicking the **Re-scan for tape drives** button, troubleshoot the drive itself.

2 Once the tape drive is listed, click the **Prepare Cartridge** button. The **Prepare Cartridge** screen displays.

Figure 2 Prepare Cartridge Screen



The **Prepare Cartridge** screen is used to prepare a tape for first use. You can also use this screen to **Load** a tape to or **Eject** a tape from the drive.

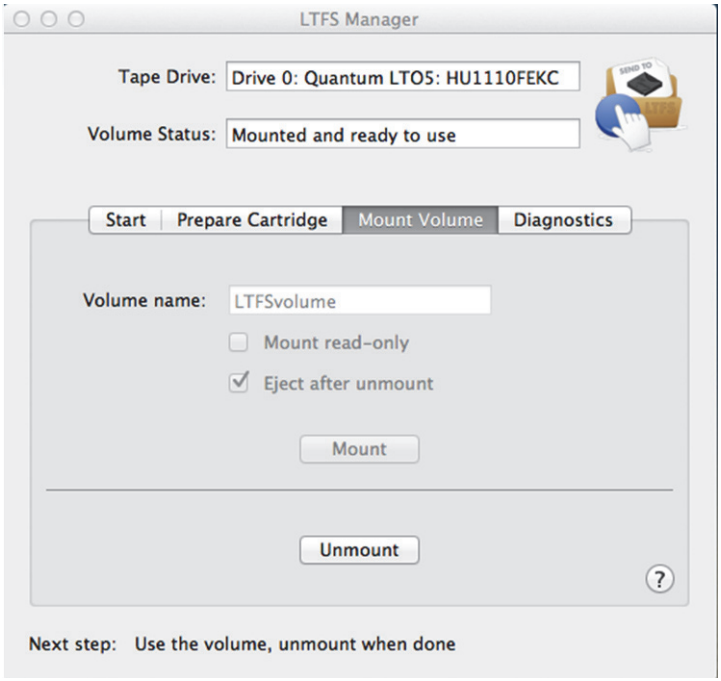
3 Click **Format** to get the tape ready for use with LTFS.

4 Click **Unformat** to erase a tape completely for use with other applications.

Caution: Using the **Format** and **Unformat** buttons completely erases all data from the tape.

5 After the tape is loaded, click the **Mount Volume** button. The **Mount Volume** screen displays.

Figure 3 Mount Volume Screen



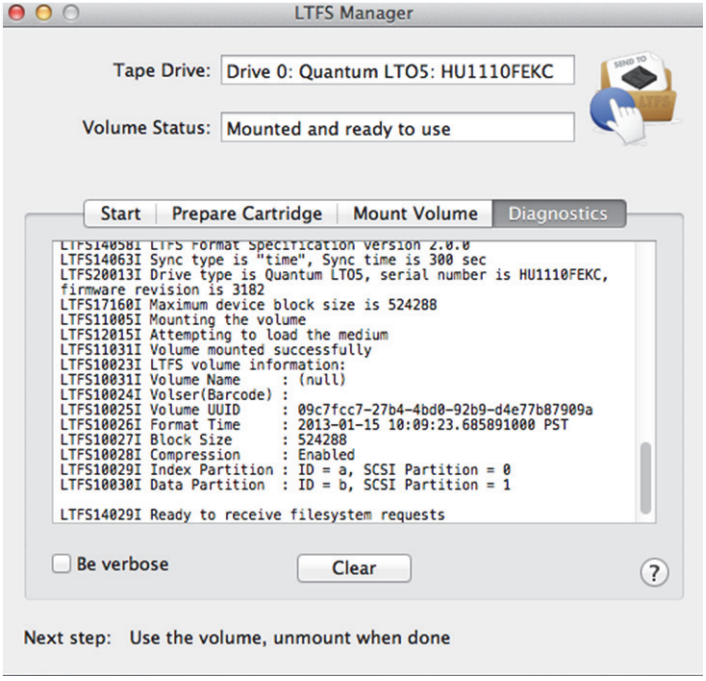
The Mount Volume screen makes an LTFS tape visible for use in the Mac GUI.

6 When finished with the tape, click the **Unmount** button. Wait until all tape motion to complete. (This can take several minutes) before ejecting that tape using the eject button.

Caution: Do not use the eject button on the appliance itself until the tape has been properly unmounted using the Unmount button on this screen. Failure to do this will cause the tape to be corrupted and could result in data loss.

7 When finished, you can click the **Diagnositcs** button to display the **Diagnostics** screen.

Figure 4 Diagnostic Screen



The **Diagnostics** screen is only used to display the output of the commands being run. This screen is used exclusively to troubleshoot any LTFS issues.

How to Use LTFS - Mac Terminal Commands

Note: : GUI application will guide you through the steps required to select a tape drive, load and format a tape cartridge and then mount the cartridge into the file system. However, command line tools are also installed and, if you prefer, you can use them instead of the GUI application.

In Mac OS X the root user is disabled by default. Mac OS X LTFS commands require that the root user is enabled. Instructions for enabling the root user in Mac OS X can be found at the following link: http://support.apple.com/ht1528

To use Quantum LTFS:

1 Ensure that /usr/local/bin/ is in your command search path. For example:

```
$ export PATH="$PATH:/usr/local/bin"
```

2 Load a tape cartridge into the drive, and then format it in LTFS format:

e.g., for Mac OS X:

```
$ mkltfs -d 0
```

Note: If the cartridge already has been formatted for LTFS, you need to use the force reformat option (-f) in some cases. Mac OS X example: `$ mkltfs -d 0 -f`

mkltfs Options

`-d<name> OR --device=<name>`	Tape device (required). For MacOS X, use the instance number of the tape drive, assigned sequentially by the system starting from 0.
`-s<id> OR --tape-serial=<id>`	Tape serial number (6 alphanumeric ASCII characters)
`-n OR --volume-name=<name>`	Tape volume name (empty by default)
`-r<rule[/rule]> OR --rules=<rule[,rule]>`	Rules for choosing files to write to the index partition. The syntax of the rule argument is: size=1M size=1M/name=pattern size=1M/name=pattern1:pattern2:pattern3 A file is written to the index partition if it is no larger than the given size AND matches at least one of the name patterns (if specified). The size argument accepts K, M and G suffixes. Name patterns may contain the special characters '?' (match any single character) and '*' (match zero or more characters).
`-o OR --no-override`	Disallow mount-time data placement policy changes

`-f OR --force`	Force reformat of existing LTFS volume (normally prevented)
`-q OR --quiet`	Suppress progress information and general messages
`-t OR --trace`	Enable function call tracing (only useful for debugging)
`-h OR --help`	This help.
`-p OR --advanced help, or --advanced-help`	Full help including advanced options.

3 Mount the formatted tape cartridge

```
$ mkdir /mnt/ltfs
$ ltfs /mnt/ltfs
```

Note: Some operating systems require creating each folder or subfolder in separate commands. For example:

```
$ mkdir /mnt
$ cd /mnt
$ mkdir ltfs
$ cd ltfs
```

ltfs Options:

`-o devname=<dev>`	Tape device (required if not using the default device: 0 for Mac OS)
`-o work_directory=<dir>`	LTFS work directory (default: /tmp/ltfs/)
`-o trace`	Enable function call tracing (only useful for debugging)
`-o eject`	Ejects the cartridge after an unmount command.

-o sync_type=<type>	Specify sync type (default: time@5) <type> should be specified as follows time@min: LTFS attempts to write an index each min minutes. Min should be the decimal number from 1 to 15372286728912 (default: min=5). Specifying an integer greater than 35791394 on 32-bit Linux systems will result in an error message and the value will not be accepted. Therefore, on 32-bit Linux systems the maximum value displayed for sync_type field is the maximum allowed integer, 35791394. close: LTFS attempts to write an index when a file is closed. unmount: LTFS attempts to write an index when the medium is ummounted.
-o force_mount_no_eod	Skips eod existence check when mounting (read only mount). Only use for a CM corrupted medium.
-a	Advanced help, including standard FUSE options
-V or --version	Output version information and exit
-h OR --help	Display this help and exit
-o umask=M	Set file permissions (octal)
-o uid=N	Set file owner
-o gid=N	Set file group

4 Write files to the LTFS volume. For example:

```
$ cp -r /root /mnt/ltfs/
```

5 Unmount the tape cartridge. This flushes the data buffer of the file system to the tape cartridge, and prepare for eject.

```
$ umount /mnt/ltfs
```

Note: The umount command will return immediately, but the drive may still be busy writing cached data to tape. Do not attempt to remove the tape cartridge, power down the system or tape drive, or delete the folder where the LTFS volume is mounted, until all tape activity has finished. Check the front panel LEDs and wait for them to stop flashing. Attempting these actions before tape activity has finished may cause corruption of the tape format.

If at some time in the future you wish to remove the LTFS format from a cartridge so that it can be reused for a different purpose, use the unltfs command. Note that the unltfs command will **IRRETRIEABLY DESTROY** all data on the cartridge. Thus use the unltfs command only when you are sure that you want to erase the LTFS volume.

unltfs Options:

`-d devname=<dev>`	Tape device (required if not using the default device: 0 for Mac OS)
`-y OR --justdoit`	This option omits the normal verification steps and reformats without further prompting
`-t OR --trace`	Enable function call tracing (only useful for debugging)
`-e OR --eject`	Ejects the cartridge after an unmount command
`-q OR --quiet`	Suppresses all progress outputs
`-h OR --help`	Display this help and exit
`-i OR --config=<file>`	Overrides the default configuration file
`-b OR --backend`	Specifies a different tape backend system
`-x OR --fulltrace`	Displays debug information (verbose)

Usage details

File permissions

The Quantum LTFS application manages a common set of file permissions for all files and users; file and directory ownership is not recorded to tape media. The only permission that is tracked is write-protect information. Files or directories that are write-protected will have permission bits set to 555; write-enabled files and directories have permission set to 777. By default the user and group information is set to that of the current user; this can be overridden by use of the -o uid and -o gid options to the LTFS application.

File types

The Quantum LTFS application does not support the creation of symbolic links or hard links within the tape file system. Attempting to create a link or copy a link to tape will result in a "Function not implemented" error. If using the cp command to copy to tape, the '-L' option may be helpful to follow symlinks.

The Quantum LTFS application also does not support creation of special files and will report "Function not implemented."

File names

To maintain compatibility when copying files between multiple platforms, it is strongly recommended that the following characters should not be used in Quantum LTFS for file names, directory names, or extended attributes: * ? < > : " | / \

Limitations

- When the tape cartridge is almost full, further write operations will be prevented. The free space on the tape (e.g. from the df command) will indicate that there is still some capacity available, but that is reserved for updating the index when the tape is unmounted.
- Future mounts of a cartridge that is almost full (has passed the point at which "early warning" is reported) will mount as Read Only, to prevent further modifications which may not fit on tape. This status is cleared when a cartridge is reformatted (using mkltfs) or when the volume is rolled back, erasing history (using ltfsck).

MAC OS X only

- LTFS does not support moving a folder within LTFS. Any attempt to move a folder in such a manner will result in an "operation not permitted" error, and the operation will be ignored. The user can still move a file within LTFS, and the user can also move a folder from LTFS to non-LTFS file system or vice versa.
- Mac OS X's Spotlight will not display the files on LTFS as a result of search.

Chapter 4
Troubleshooting

This chapter contains the following sections:

- Shared libraries
- Using Quantum LTFS to check the cartridge

General

If problems occur during Quantum LTFS operation, entries may be made in the system log (e.g., /var/log/messages on Red Hat systems). Check for entries made with the service name "ltfs."

ltfs, unltfs and mkltfs all have command line options to report further details of the operations undertaken, which may be of assistance when trying to troubleshoot problems.

If there is a problem with drive interaction, Quantum LTFS will attempt to create a snapshot of the drive internal state at the time of failure.

- On Linux systems: this will be stored in the system log directory (e.g. /var/log/) and will take the form ltfs_datestamp_timestamp_driveSerialNum.svm.
- On Mac OS X systems: the snapshots are stored in the directory ~/Library/Logs/LTFS/.

Note: Mac OS X version 10.7 (Lion) and later by default hides the user Library folder (/Users/{username}/Library or ~/Library) and thus is not displayed in Mac OS X Finder or by any other terminal command which lists folder contents. There are several methods to display the user Library:
1. For quick and temporary access to the user Library folder, in Finder select "Go", "Go to Folder" (or use (Command+Shift+G) and enter "~/Library"
2. For permanent access to the user Library folder, enter the terminal command "chflags nohidden ~/Library"
3. Enter the terminal command "open ~/Library" which will access and display the user Library folder via Finder

These files are not otherwise used by Quantum LTFS and they may safely be removed from the system, if they are not needed for troubleshooting.

Shared libraries

On some systems, trying to execute the ltfs and mkltfs commands may result in an error message of the form libltfs.so.0: cannot open shared object file: No such file or directory.

To resolve this, it is necessary to tell the linker/loader how to locate the required dynamic library files.

There are several ways of doing this:

- Add /usr/local/lib/ to the environment variable LD_LIBRARY_PATH, or
- As root) Add /usr/local/lib/ to the file /etc/ld.so.conf, and then execute /sbin/ldconfig.

Refer to the man pages for ld.so and ldconfig for further details.

Similar error messages may occur if one or more required shared libraries are not present on the system, or are present but at the wrong revision.

Drive connection

The Quantum LTFS application requires that the LTO-5 or later tape drive is powered up and properly connected to the system. Issue the following command to verify:

e.g., for Linux:

```
cat /proc/scsi/sg/device_strs
```

e.g. for Mac OS X:

Use the Mac OS X System Profiler utility to check LTO tape drives connected to your SAS controller.

If a LTO drive is not properly connected, check the power status and cabling from the SAS connector to the LTO drive. Quantum LTFS will not be able to operate untuil a LTO-5 or later drive is detected.

Using Quantum LTFS to check the cartridge

Every time a cartridge is mounted onto the system, the Quantum LTFS application will perform a consistency check to ensure that the index information is accurate and up-to-date with the data on the tape. If for some reason there is a problem, the mount operation will fail.

In order to recover the tape to a consistent state, the ltfsck utility may be used to check and repair the LTFS volume. The options to ltfsck are shown below; the only required parameter is the device name (e.g. /dev/st0 on Linux) but the behavior of ltfsck can be controlled through the following:

Usage: `ltfsck <options> filesys` where `filesys` is the device file for the tape drive

`–g<generation> OR –-generation=<generation>`	Specify the generation to roll back
`–t<time> OR -–time=<time>`	Specify the time to rollback. Time value should be "yyyy-mm-dd HH:MM:SS.nanosec"
`–r OR -–rollback`	Rollback to the point specified by -g or -t
`-n OR -–no-rollback`	Do not roll back, just verify the point specified by -g or -t (default)
`–f OR --full-recovery`	Recover extra data blocks into directory _ltfs_lostandfound

`-z OR --deep-recovery`	Recover cartridge which has EOD missing. **Note:** Some blocks may be erased, but can recover to a final unmount point which has an index version "2.0.0" or earlier. Data written to tape before the final un-mount point still can be recovered. Blocks that were written when power to the drive was lost however, are not recoverable. **Note:** The -z (or -deep-recovery) option is applicable to drive firmware later than V30857000. This option requires index information from cartridge memory (CM) to recover as much data as possible. CM corruptions can prevent the successful completion of this option.
`-l OR --list-rollback-points`	List rollback points
`-j OR --erase-history`	Erase history at rollback. If the -j option is utilized, the ltfsck command erases all index files and appended data up to the designated rollback to generation. Data newer than this generation cannot be recovered. If the -j option is not utilized, any existing generation can be recovered even following a rollback operation.

-k OR --keep-history	Keep history at rollback (Rollback)
-q OR --quiet	Suppress informational messages
-a OR --trace	Enable function call tracing
-h OR --help	This help
-p OR -- advanced help	Advanced help option

Appendix A
Frequently Asked Questions

This appendix provides answers to frequently asked questions for Quantum LTFS.

Q: How do I get Quantum LTFS?

A: All application downloads and documentation are available from the website at: www.quantum.com/LTFS

Q: What are the minimum system requirements?

A: Any server that fulfills the needs of the supported configurations detailed in Chapter 1, Supported configurations on page 4.

Q: Does Quantum LTFS support DDS/DAT devices?

A: No. The application will only work with LTO drives.

Q: Does Quantum LTFS support non-Quantum tape drives?

A: Quantum's version of LTFS has been validated to work with both the Quantum and HP LTO-5 and LTO-6 drives. Quantum's LTFS also recognizes other LTO vendor's LTO-5 and LTO-6 drives although Quantum does not perform complete testing on these drives. Quantum's technical support is only equipped to provide support for Quantum LTFS using the Quantum drive.

Q: Why doesn't Quantum LTFS work with my LTO–4 or earlier drives?

A: Quantum LTFS relies on a drive feature called partitioning, which was added to the LTO–5 format. It is not part of the LTO–4 or earlier tape formats and they cannot be used.

Q: Can I use LTO–4 media in my LTO–5 or LTO-6 drive?

A: The LTO–5 drives can load, read and write LTO–4 media and LTO-6 drives can load and read (but not write) LTO-4 media. However, the LTO–4 format does not support partitioning. Therefore, LTO–4 media

cannot be used with Quantum LTFS.

Q: Can I use WORM media with Quantum LTFS?

A: No, WORM media cannot be partitioned and so is not usable with Quantum LTFS.

Q: Can I uninstall Quantum LTFS?

A: Yes.

Linux: Use the following command in a terminal window:

```
$ rpm -e qtmltfs
```

Mac OS X: delete the tree under /Library/Frameworks/LTFS.framework. To also delete the ICU package, delete the tree under/Library/Frameworks/ICU.framework.

Q: Where do I go if I have a problem?

A: For most common issues, see Chapter 4 on Troubleshooting. If this does not address the issue, call Quantum support.

Q: Does Quantum LTFS replace my existing backup software?

A: In most cases Quantum recommends that you continue to use your existing backup application. Quantum LTFS provides a good method of storing and transporting large files but is not generally a direct replacement for a backup application.

Q: Is source code available for Quantum LTFS?

A: Yes, full source code is released under the terms of the LGPL 2.1 license and can be downloaded from www.quantum.com/LTFS. However Quantum is not equipped to support customers who choose to download and build their own versions of the Quantum LTFS application.

Q: How do I verify that Mac OS X is running with a 32-bit kernel?

A: From a terminal window, issue the following command:

```
$ uname -a
```

The command response should indicate **i386**, not **x86_64**.

Q: How do I modify Mac OS X to boot with a 32-bit kernel?

A: From a terminal window, issue the following command:

```
$ sudo systemsetup -setkernelbootarchitecture i386
```

Reboot the system.

From a terminal window, issue the following command:

```
$ uname -a
```

The command response should indicate **i386**, not **x86_64**.

Q: Under what conditions is LTFS log file not created and updated?

A: The LTFS log file may not be created and warning messages issued in either of the following cases:

- The LTFS process does not have write permission for the log directory
  Resolution: Run ltfs as root or use the log_directory option to specify a directory for which the ltfs process does have the required write permissions
- The log directory does not exist
  Resolution: Create the default log directory or use the log_directory option to specify a directory for which the ltfs process does have the required write permissions

Q: The LTFS process will not start?

A: LTFS requires that a LTO-5 or later tape drive is powered on and properly connected to the system before it will start LTFS.